FAA AVIATION NEWS

OCTOBER 1968

COVER

Jet powered compound helicopters like this artist's conception may be used to carry passengers to and from downtown heliports up to 300 miles apart. For a look into the future, see page 8.

FAA AVIATION NEWS

DEPARTMENT OF TRANSPORTATION / **FEDERAL AVIATION ADMINISTRATION** VOL. 7 NO. 6

CONTENTS / October 1968

Page 8

Page 10

David D. Thomas, *Acting Administrator, FAA*
Charles G. Warnick, *Director of Information Services*

Lewis D. Gelfan, *Editor*
Frank J. Clifford, *Assoc. Editor.* Abner B. Cohen, *Art Director*

FAA AVIATION NEWS is published by the Office of Information Services, Federal Aviation Administration, Washington, D.C. 20590, in the interest of aviation safety and to acquaint readers with the policies and programs of the agency. The use of funds for printing FAA AVIATION NEWS was approved by the Director of the Bureau of the Budget, July 14, 1967. Send change of address to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, with a mailing label from any recent issue. Single copies of FAA AVIATION NEWS may be purchased from the Superintendent of Documents for 15 cents each.

Superintendent of Documents,
Government Printing Office,
Washington, D.C. 20402

Enclosed find $........... (check or money order). Please enter my 12-month subscription to FAA AVIATION NEWS ($1.50 domestic; $2.00 if mailed to foreign address).

Name ....

Address ....

....

........................Zip.............

Nose to tail lineup of aircraft dramatizes need to cut flights at Kennedy, LaGuardia, Newark, O'Hare and Washington National.

FAA WEIGHS BUSY AIRPORT RESTRICTIONS

RESTRICTIONS on the number, type and equipment of aircraft using airports in New York, Washington and Chicago have been proposed by the Department of Transportation as a means of easing aviation congestion in the three cities.

In a notice of proposed rulemaking, the Federal Aviation Administration designated John F. Kennedy, LaGuardia, Newark, O'Hare and Washington National Airports as "high density airports." At each of these airports, a fixed number of instrument flight rule operations (takeoffs and landings) per hour would be allocated for reservations.

Under the proposed rule, Kennedy, LaGuardia, Newark, O'Hare and Washington National Airports would be allocated 80, 60, 60, 135 and 60 operations per hour respectively. The limitations would be effective from 6:00 a.m. to midnight.

The proposed regulation also allocates the reservations among the various classes of airport users.

Of the 80 operations allocated for JFK Airport, 70 would be reserved for scheduled air carriers, five for air taxis and five for other operations, except for a three-hour period beginning at 5:00 p.m. when all 80 operations would be reserved for air carriers.

Of LaGuardia's 60 operations, 48 would go to the air carriers, 6 to air taxis and 6 to other operations.

Operations at the remaining three airports would be divided thus: Newark—40 air carriers, 10 air taxis and 10 other operations; O'Hare—115 air carriers, 10 air taxis and 10 other operations; Washington National—40 air carriers, 8 air taxis, and 12 other operations. Extra sections of scheduled air carrier flights at Washington would not count against the total limitation.

The rule states that, "The proposed allocations of reservations reflect the obligation of the Department of Transportation to provide for efficient utilization of the air space and recognize the vital role of the certificated common carriers' scheduled operations in air transportation.

"The proposal recognizes a greater priority for scheduled air taxi operators as they are also common carriers of the public. The proposal takes into account the relative inflexibility of scheduled operations compared to unscheduled operations. The proposal accommodates all classes of users and no one would be totally denied access to any of the named airports. The proposed restrictions will affect all users if adopted."

The proposed rule also would require aircraft operating into the airports under the reservation plan to be able to maintain an airspeed of not less than 150 knots while under the jurisdiction of air traffic approach control. In addition, all aircraft would have to be equipped with a radar beacon transponder with a 64 code capability and would have to have two pilots.

The proposed rule points out that the limitation figures are in excess of the capacities of the airports to handle IFR traffic in IFR conditions. The limitations were chosen, however, with the knowledge that when weather conditions are better than IFR, the ability of the airports to handle additional traffic increases.

Under the proposed rule, prior approved departure or arrival reservations would be required for each flight operated under instrument flight rules to or from a designated high traffic airport. Approvals would be granted by Air Traffic Control up to the allocated limitations. Air carrier would be able to obtain reservations by publication of the flight schedules. Other operators would obtain reservations by contacting flight service stations.

The proposed rule will allow operations in excess of the allocated reservations when permitted by weather or other factors. It will be necessary for an aircraft operator to apply for a reservation, but the aircraft will not be required to meet the performance capabilities, or flight crew and equipment requirements prescribed by the proposed rule if operating VFR.

Scheduled air taxis would be permitted to use any air carrier reservations not taken by the scheduled air carriers. In the event the total reservations allocated for the scheduled air carrier and air taxi operations were not taken by those operations for any hour, the remaining reservations would be available for other operations, principally general aviation. Accordingly, the proposed rule points out, general aviation operating under IFR conditions would be limited to the figures specified for "other" operations in the allocation formula only when the air carriers and air taxis used their full allocation. At all other times, general aviation would be permitted more use than the tables indicate.

Deadline for submitting written comments on the Notice of Proposed Rule Making (Notice 68-20; Docket 9113) is October 9, 1968. Comments should be submitted to: Federal Aviation Administration, Office of the General Council, Attention: Rules Docket, GC 24, 800 Independence Avenue, S.W., Washington. D.C. 20590. ■

LET THERE BE LIGHT!

The story behind an alert mechanic's important discovery that led to fame and good fortune.

(Editor's note: Dean Webster, who works at United Air Lines' San Francisco Engineering and Maintenance Base, earlier this summer was named the nation's top air carrier mechanic in FAA's Fifth Annual Aviation Mechanic Safety Award program. In this article, he tells in his own words how he came to develop the inspection procedure that won him the FAA award, and the richest cash award made to an individual in United's history.)

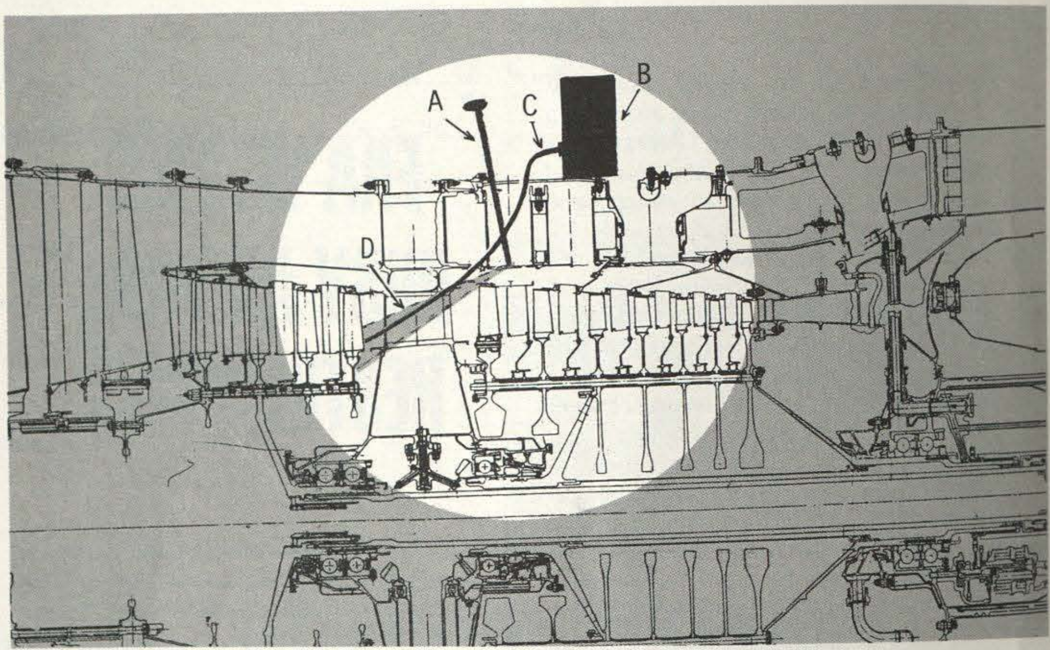
IT HAS BEEN said "Necessity is the mother of invention." The development of this inspection procedure was no exception.

When the Boeing 727 airplane was added to the United Air Lines fleet, a new engine, the Pratt & Whitney JT8D, was introduced to the commercial airline industry. Little was known about where fatigue wear and failure might occur in this engine during normal commercial service. For this reason, while the engines were in the shop for repair, maintenance specialists including myself would spend as much time as possible peering into the ducts, orifices, and passages, noting what could be seen, and whether or not any problems were materializing.

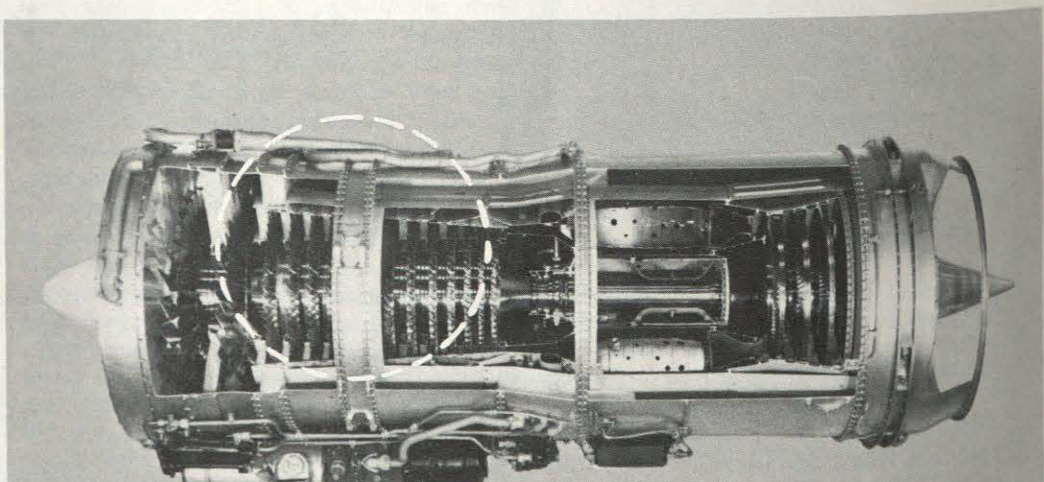
I was aware of the fact that a borescope —a long, narrow tube with lenses, a mirror and a light source, used for examining deep cylindrical cavities—was being used to inspect combustion chambers. I borrowed a borescope and inserted it inside the sixth stage air bleed duct port, to see the condition of the engine compressor blades.

At first I found it impossible to see anything, because the light source on the end of the borescope would not allow the instrument to penetrate deep enough to position the viewing lens advantageously. Then I got the idea of removing the light bulb and using a flexible light rod.

This was partially successful, although the light was insufficient. I could dimly make out a set of compressor blades, and by having a mechanic rotate the blades I was able to identify them with the sixth stage compressor. At this time the discovery meant little to me.



Above—Webster gained access to the compressor section of the engine through the sixth stage duct port. Shown are (A) the borescope, (B) the light source, (C) the flexible light rod, and (D) the field of vision. Below—Cut-away of JT8D turbofan engine shows compressor section (left), combustion chambers (center), and turbine section (right). Circled areas in diagram and cutaway correspond.



Sometime later while reading a Pratt & Witney Service News Letter which said they had developed a means of inspecting the compressor for sixth stage blade lock failure, I realized the industry had a problem in this area. The letter went on to say the inspection was accomplished by drilling a hole through the engine case to allow borescope inspection. The Pratt & Whitney letter also said they had encountered metal cracking where the holes had been drilled, but they expected to solve this problem soon.

United Air Lines' procedure for inspecting the sixth stage compressor was to separate the "hot" (the combustion and turbine—section from the "cold," or compressor section) a costly and laborious task.

I approached our technical services group

with my suggested procedure, explaining the need for a more powerful light source plus an assortment of light rods. The larger light source and light rods were obtained, and I was able to see the compressor blades clearly through the borescope.

My suggestion was accepted immediately and evaluated over a one year period. During that time, every JT8D engine which made a shop visit and was not disassembled for some other reason was inspected by this method.

Six engines were found to have suffered early failure in the sixth stage compressor. Since these engines would not have been disassembled (except for the findings of my inspection procedure) the potential loss from such engine failure formed the basis for the cash award I eventually received from the company—$14,645. This amounted to 10 per cent of the typical failure cost for six engines.

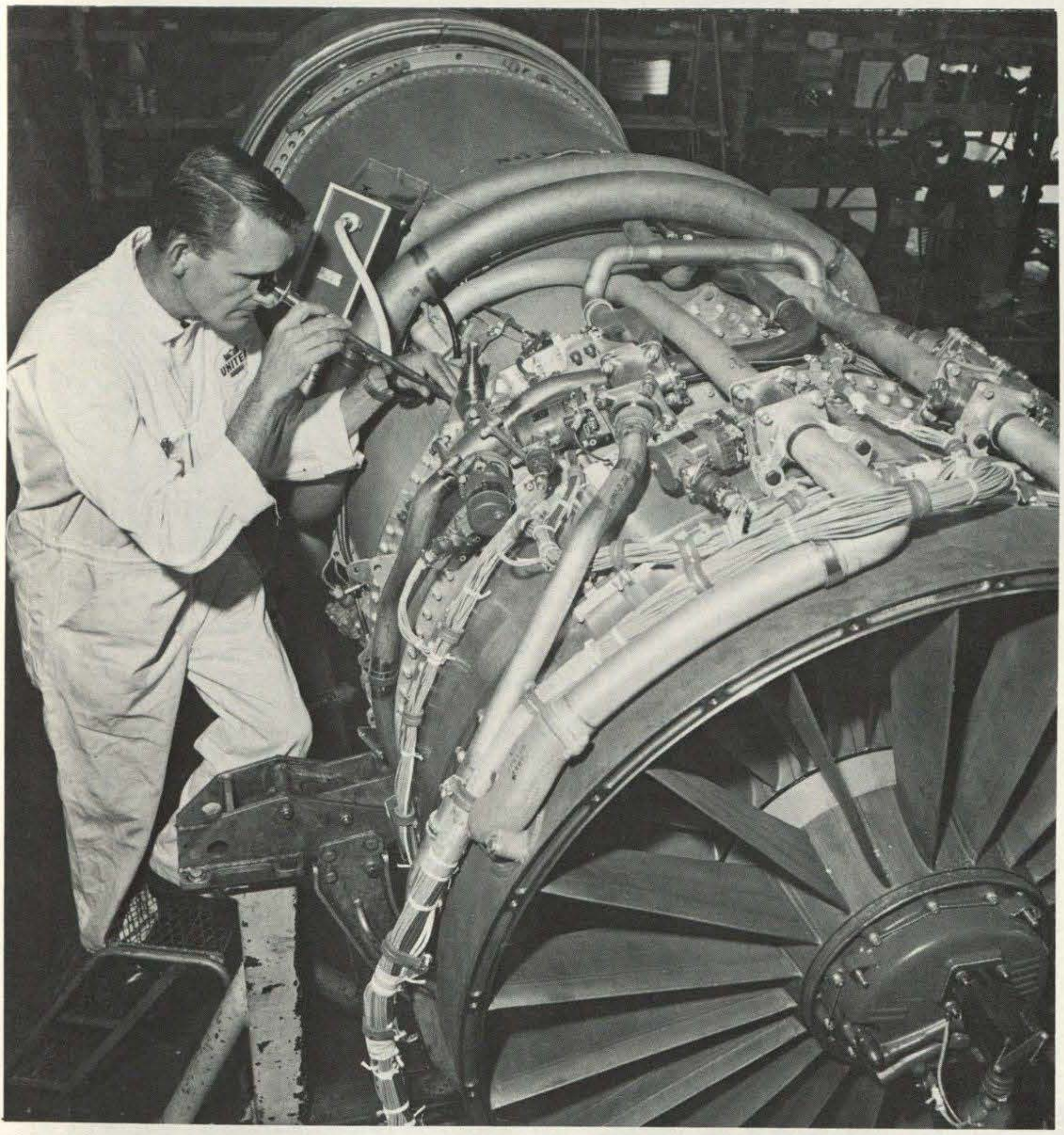
As a result of this suggestion, United Air Lines chose me "Suggestor of the Year" and invited my wife and myself to the President's Award Dinner in Chicago. The "Suggestor of the Year" award carried with it a desk plaque, two additional weeks paid vacation and $750 tax free.

My procedure was submitted for consideration in the FAA Aviation Mechanic's Safety Award competition. I was chosen both the Regional and National winner in the air carrier category. The national award resulted in a trip to Washington, D.C. for my wife, children and myself for the presentation of a plaque and $500.

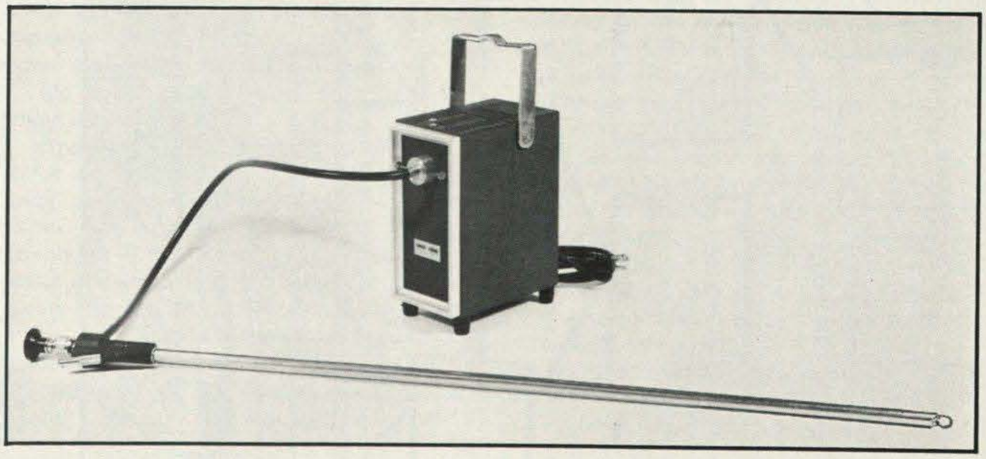
After paying taxes on the awards, I used a small amount to complete an addition on my home. The balance was invested for the education of my five sons.

To others in the aviation industry I would say I owe the success of my discovery to the following philosophy: Regardless of how simple or routine the assignment might seem, never lose sight of the responsibility assigned to you. Accept that responsibility and try to go one step further. Things are rarely so perfect they can't be improved upon.

Dean Webster



Above—Webster inserts borescope. Light source and flexible light rod are at his left. Left—Dean Webster in his native habitat, surrounded by jet engines, at United Air Lines San Francisco Engineering and Maintenance Base. Below—Borescope and light source combination. Webster removed bottom light for deep penetration, and substituted flexible light rod.



A TREE GROWS IN WASHINGTON

At FAA Headquarters in Washington, D.C., a dozen men have been working for more than six months growing a "logic tree" whose fruits, as yet wholly unknown, will nourish a new development in aircraft collision avoidance. The "logic tree" is rooted in the rich supply of near midair collision reports which have been flowing into the agency since the beginning of 1968.

For the past ten years the Federal Aviation Administration has been patiently assembling data which would help shed some light on the causes of midair collisions. Not only have all accidents been exhaustively investigated, but FAA has also solicited information from all aircraft involved in incidents where two or more aircrews apparently attempted to occupy the same airspace at the same time. Before proposing any new regulations designed to reduce midair accidents, the agency intends to isolate the kinds of circumstances which are most likely to create an airspace conflict.

In the past, FAA has felt that the near midair collision reports filed with the agency represented only a fraction of the actual number of such incidents, since aircrews were not bound by regulation to report them, and many were reluctant to make a statement which might draw a company or agency penalty down on their own head or on the heads of their fellow pilots.

In order to gain a more accurate picture of the occurrence of midair incidents, FAA declared 1968 to be a year of immunity in which no investigation, enforcement, or other adverse action would be taken against aircrews involved in reported incidents; and anonymity would be granted to all concerned. At the outset it was recognized that this program would have to be a joint effort by the aviation community and FAA.

The flow of reports to the agency has stepped up considerably since the first of the year. The task of classifying all this information into useful tools for the rulemakers falls to the NMAC Study Group, technical experts with backgrounds in air traffic and operations research, who are using computers to digest the mountain of data in their hands.

One near midair collision (NMAC) report is requested from each aircrew involved in an incident, in order to provide both points of view. In addition, air traffic controllers who observe midair incidents are also advised to file a report.

The NMAC report forms, which are available from all FAA facilities, are simple to follow and can be filled out in a few minutes. Yet the completed form may supply as many as 250 distinct pieces of information. By a system of analysis known as a "logic tree," this information is grouped together into areas of concern and for ready acceptance by a giant 360 computer.

The primary breakdown separates the reports into three categories: *No Hazard, Potential* and *Critical.* The no hazard group includes all incidents where the pilots had ample time to judge the possibility of a conflict and to alter course without difficulty. Potential incidents are those which apparently required immediate evasive action to avoid a collision. Critical incidents are "near-misses" which did not allow time for evasive action, and where disaster was averted by chance.

The potential and critical incidents are next broken down into *enroute* and *terminal* occurences. These two categories are further analyzed according to type of flight of both aircraft involved—such as VFR-VFR, VFR-IFR, or IFR-IFR. These groupings are further studied as to altitude, airspeed, weather conditions, and many other pertinent operational factors.

Bar graphs in each category show at a glance the rate of occurrence, so that the "logic tree," although only half grown, is already beginning to bear significant fruit. Display of the logic tree and a large U.S. map with markers showing the location of each report are used for daily briefings of the Administrator and his staff.

In time, it will be possible to request such computerized information as, "How many midair incidents occurred between military and general aviation aircraft after dark above 10,000 feet under VFR conditions near major terminals?" or "How many enroute incidents occur between VFR and IFR aircraft?" and receive an immediate reply.

In the preceding decade, there has been an average of 20 midair collisions a year, while *reported* near midair collisions averaged 550. However, the mushrooming growth of all segments of aviation, and concentration of flights over major air terminals and the higher speeds of modern jets, have all contributed to the difficulty of reducing the midair hazard. Concern has been expressed, by the public and some segments of industry, over a need for the development of highly sophisticated instruments for preventing midair collisions.

Some groups have called for FAA regulation of air traffic in some manner as to provide greater safety in the air. Still others maintain that NMAC encounters stem primarily from a disregard for the "Rules of the Road" which govern safe navigation in the air, and that stiffer enforcement is in order. Before responding to any of these requests, FAA intends to pinpoint the conditions of greatest hazard. The accuracy of its analysis will depend, in part at least, on the continuing cooperation of aircrews and their promptness in filing NMAC reports.

Most pilots do not have to be told twice—no one is more interested in contributing to aviation safety than those who fly regularly. Even the incidents which cause no stir in the cockpit, and would be classified as *no hazard,* may provide important clues to air safety. The rule for all aircrews interested in reducing the chance of a midair tragedy is: When in doubt, file a report. ■

FAA's "logic tree" with bar graphs showing various kinds of near midair collisions and where they occur.

A three-year study of 15,977 accidents by FAA's Office of Aviation Medicine showed about 10 per cent of them involved pilots with two or more accidents.

ACCIDENTS CAN BE A WARNING

"He was hard on all equipment."

This six-word statement is both an indictment and an epitaph. It lies buried in a thin accident dossier in an FAA file marked "CLOSED." The subject was killed in an aircraft accident—his *third in 15 months*. Was it bad luck?—or was he an accident repeater?

An experienced pilot with more than 2,000 hours, his first accident happened on a hot, calm day in June 1964, when he brought his heavily-laden light twin in with a hard landing that caused major damage to the landing gear and both wings. The landing gear and wings had to be replaced.

Flying the same airplane, he had his second accident in March 1965. The FAA inspector investigating the mishap stated in his report that "... the airplane was apparently lifted off too soon, with premature retraction of the landing gear, and resultant settling back down on the runway." Once more there were no injuries, but the plane was again substantially damaged.

Inspector Surprised

The FAA inspector interviewing the pilot was surprised by his lack of concern about the two major accidents in less than a year.

His final flight took place in October 1965, bewteen 1:30 and 2:00 a.m., when the airplane he was piloting with a female passenger aboard crashed and burned about seven miles from the airport. Examination of the wreckage disclosed no malfunction or maintenance discrepancy. The blood alcohol content of the pilot, however, was 96 mgm per cent per 100 milliliters of blood.

The FAA general aviation district office noted that this pilot had a reputation of being "... lax regarding safe flight practices and allegedly flew while under the influence of alcohol on many occasions." In other words, this pilot's flying habits were accident-conducive.

Another pilot, with a commercial and flight instructor certificate, managed to cram four serious accidents into a two-year period. Even though he had 600-plus hours, he apparently forgot to lock the landing gear down and it collapsed on landing. A few months later, he landed a plane with the wheels up. His third accident occurred when he taxied into a parked aircraft, which earned him a citation for careless or reckless operation. In his fourth accident, he lost directional control following a cross wind landing.

In all these incidents, the aircraft involved sustained major damage; fortunately, there were no injuries in any of them.

Do some people have more accidents than others?

Apparently so, according to a study by FAA of 15,977 general aviation accidents over a three year period—1964 through 1966. The survey isolated 1,534 accidents involving 729 pilots who figured in two or more accidents. Of these, 660 had two accidents, 62 had three accidents, and *seven pilots were involved in four accidents.* The "accident repeaters" accounted for about 10 per cent of the 15,977 accidents surveyed.

In the fatal accidents, 78 pilots were killed in their second accident, seven died in their third accident, and two in their fourth accident. These 87 fatal accidents amounted to about 12 per cent of the accidents involving the 729 "accident repeaters."

The 1,534 accidents were thoroughly analyzed in an attempt to fix the specific cause. Since there is frequently more than one causal factor for a given accident, the various factors contributing to an accident were further divided into categories intended to identify a pattern, if one existed.

Misjudgment, mistakes, carelessness and recklessness, weather and pilot incapacitation (medical, alcohol, other) were grouped under general causal factors. Operational factors includued failure to maintain adequate flying speed, misuse of the landing gear system, continued flight into adverse weather, etc. Weather, icing, etc., were listed under contributing factors.

Reckless operation was cited as a factor in 75 accidents and carelessness was present in 42 accidents. Pilot incapacitation was cited as a general causal factor in 30 accidents, with 19 pilots considered to have been affected by alcohol.

Health Plays Part

There were four accidents attributed to medical causes, all of them fatal. Non-specific myocarditis figured in one; one was due to coronary artery disease; and two were attributed to the pilot taking off in spite of illness prior to flight. One of these pilots fainted several times and complained of chest pain the day before his fatal flight. Two other accidents occurred because of chemical poisoning associated with crop dusting.

Analysis of the 1,534 accident studies showed that the Alaskan Region was the most dangerous in terms of repeater accidents. Approximately 18 per cent of the fatal, and 23 per cent of the non-fatal, accidents in Alaska involved repeaters. By comparison, in the Southwest Region, repeaters were involved in only 11 per cent of the non-fatal accidents, and about 8 per cent of the fatal accidents. The Central and Eastern Regions show the lowest percentage of repeater accidents, with approximately 6 per cent of the non-fatal and 3 per cent of the fatal accidents reported involving "second time around" pilots.

Among professional accident investigators, it is a truism that accidents don't just happen—they are caused, mainly by habitual human failure to observe personal limitations, or limitations imposed by weather or mechanical capability.

One accident is a clear danger signal; two accidents demand a consultation with a competent flight instructor, and possibly a thorough physical checkup. With help, a smart pilot can kick the accident habit.

Rowland H. Bedell, M.D.
Chief, Accident Investigation Branch, FAA

Above—Passengers in mobile lounges in Dulles Airport are transported in air-conditioned comfort directly from the terminal to the aircraft, eliminating need for fingers, satellite extensions and moving sidewalks. Left—Mobile lounge, specially designed for Dulles, is the largest rubber-tired passenger carrying vehicle ever built. Capacity, 90 passengers.

THE age of aviation has only just begun. Over the next ten years, we anticipate a fantastic expansion. Our present fleet of over a hundred thousand active civilian aircraft will *double*. Many of the aircraft will be jets—some supersonic. There will be hundreds of vertical or short field takeoff and landing type aircraft. The small, single engine aircraft will still outnumber all others. Airspeeds will vary from about 100 miles per hour to *1,800 miles per hour*. All aircraft will have one thing in common—a desire to land and takeoff from the airport nearest their destination.

To give you some perspective on the kind of air traffic expansion we are facing, let me point out that only 10 years ago, in 1958, there were fewer than 50 million aircraft passengers in the United States per year. In 1968, commercial and private aircraft will carry about *150 million* persons. In the decade to come, this figure will again triple. Air passengers will soon exceed one million *each day of the year*.

Aircraft operations (landings and takeoffs) will also triple in ten years. Looking only at those airports where we have FAA control towers, about 325, we already log more than 50 million takeoffs or landings per year. Eight of our busiest towers now handle an average of over 1,000 operations per day. Imagine three times that number of aircraft movements in a single day at one terminal area.

Narrow End of the Funnel

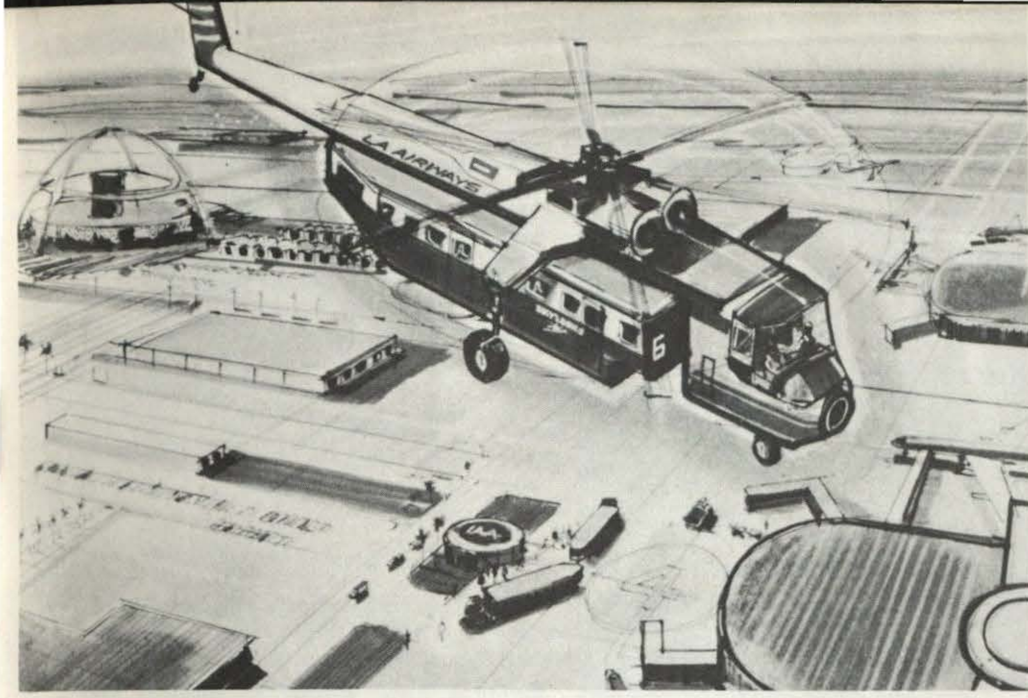
How are we going to handle this tremendous increase in air traffic? Obviously we cannot match the increase in air travelers with a proportionate increase in our personnel. If we did so, even in air traffic alone, we would require 60,000 air traffic control specialists.

Even this would not solve the problem of diminishing space. The airport and the airspace immediately surrounding it form a kind of funnel through which all aircraft and air travelers must flow. Our problem is how to accommodate a vastly larger, faster flow of air traffic without jamming the funnel—or how to pull three rabbits out of a hat which now barely accommodates one.

The narrow end of the funnel rests on the ground—the airport. We have about ten thousand airports in this country, but the majority of these are small fields without facilities required for air carrier aircraft. We have fewer than 700 airports with runways longer than 6,000 feet—and more than 100 of those airports are in Alaska. We have some 21 major hub areas through which the great majority of air travelers pass. The space we have for aircraft on the ground near major cities will not increase very much in the next ten years, largely because airport real estate has become extremely expensive and modern airports are very costly to build. Dulles Airport, for example, built more than five years ago on relatively inexpensive countryside, cost more than 110 million dollars.

We know that unless we give them some help, the larger hubs will soon be facing delays of from one to two hours during the busy days of the week. The most effective way of relieving delays at airports is to build new ones, and whenever feasible, we are encouraging this through our Federal-Aid-to Airports Program.

We are also encouraging the construction of parallel runway systems at airports. The traditional airport runway pattern has looked something like a footprint of a chicken, with two or three runways intersecting each other to accommodate various wind directions. We have learned that airports with parallel runways, preferably more than 3,000 feet apart, or if possible 5,000 feet, such as Dulles or O'Hare Airports, are able to handle landing and takeoff operations simultaneously. We are recommending



Above—Consideration is being given to using "Skycrane" helicopters with passenger pods to move air travelers to and from downtown locations, and from smaller airports to major air terminals. Left—In the future, passengers may be ticketed and reliveed of their luggage at off-airport depots, and transported to the airport by bus, subway, or rapid rail. Service travel delays will thus be eliminated.

TH
IE FUTURE"

ie flow of Airport Traffic

RT I

this construction or modification wherever possible. At some airports, the addition of a small parallel runway for use of light planes has proved very helpful in speeding up the flow of traffic.

Some relief in the future may come from the increased use of heliports and separate STOL ports or airports with very short runways that will accommodate the aircraft able to take off or land vertically or within a few hundred feet. These airports can serve the needs of commuters in aircraft designed for this purpose. In a recent exercise at New York City, the capacity of helicopters and STOL aircraft to airlift emergency supplies and personnel to the city by using parks, piers, and other small open spaces was successfully demonstrated.

Another remedy under study for the relief of traffic delays at airports is *controlled scheduling*. At Washington National Airport, the scheduled air carriers have been asked to restrict scheduled operations to 40 per hour during the entire course of the day. This scheduling does away with the bunching up of aircraft arrivals and departures during peak or favorite hours of the day. By limiting the operations each hour to a number which can be handled smoothly, an airport can operate at peak capacity during the entire day without long delays for the passengers. At the moment, Washington National is the only U.S. airport which limits air carrier schedules.

Adverse weather is still a heavy contributor to airport delays. In heavy fog or low clouds, the landing of aircraft is slowed considerably, or they may be diverted to other airports dozens or perhaps hundreds of miles away. Within the next decade, we shall have perfected the technique of *all-weather landing* which means that we will be able to bring aircraft in through the heaviest fog, in zero-zero visibility. Computer-informed autopilots enable us to accomplish completely hands-off landings in our experimental program being carried on at the National Aviation Facilities Experimental Center, Atlantic City, and elsewhere by specially equipped air carriers.

Off-Airport Loading

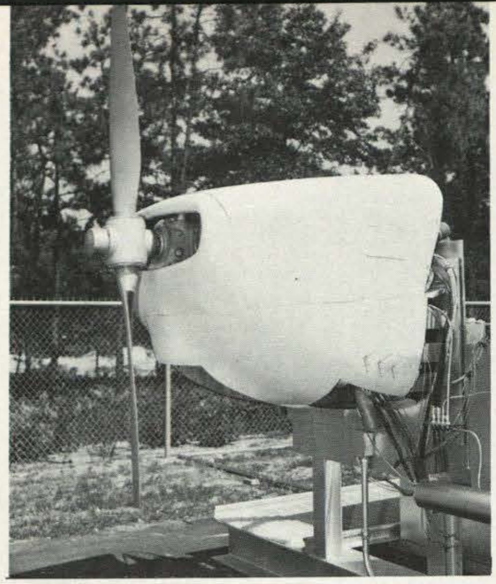
As aviation moves into the mass transportation stage in the next decade, we shall be forced to provide radical solutions to the problems of handling the hundreds of passengers who will be accommodated in a single aircraft. For high density airports, one such solution is off-airport processing. Except for persons who are changing aircraft, the air traveler in the next decade will be able to complete the boarding process at an off-airport depot in the center of town, where he will be ticketed and surrender his baggage. He will then proceed directly to the airplane by means of bus or subway or perhaps some more exotic form of transportation, such as monorail. A half dozen buses will be able to transport the same number of passengers to an airplane that would require 200 automobiles—thus relieving congestion on highways leading to airports and in airport parking lots which otherwise would soon require more acreage than runways. The mobile lounge system, already in use at Dulles Airport, is an intermediary stage of this concept which entirely eliminates fingers, satellite extensions, moving sidewalks, etc.

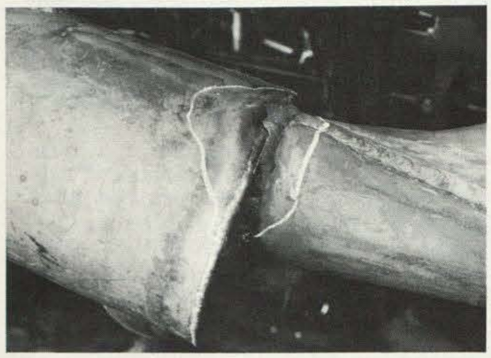
Cargo will also be loaded on aircraft by some process of direct shipment, such as special vehicles which can be driven directly on the aircraft. In this manner, boarding and loading will be synchronized to the speed of air travel.

OSCAR BAKKE
Acting Deputy Administrator, FAA

A second article in this series will discuss expansion of the airspace.

TAMING HOT EXHAUST GASES





Top—Using the normal mounting structure, the engines were installed on rugged test stands where some of them were run for as long as 80 hours a week. Bottom—Cracked carburetor heat housing is typical exhaust system failure. Some systems failed shortly after 100 test hours.

Materials more resistant to oxidation and high temperature corrosion promise longer life, reduced maintenance costs, and increased dependability for general aviation aircraft exhaust system components.

This is one of the conclusions reached after two years of testing at the National Aviation Facilities Experimental Center (NAFEC) in New Jersey, under direction of FAA's Aircraft Development Service. Chrome-nickel alloys under examination demonstrated greater safety protection for the pilot than the stainless steel alloys in general use.

A review of general aviation aircraft engine exhaust system failures over a five-year period revealed that there were many cases in which exhaust gases were reported in the cabin, 12 fatalities from carbon monoxide poisoning, 14 engine fires, and 70 incidents of power loss. As a result of these problems, a test program was conducted at NAFEC on a variety of engines and exhaust systems.

Heat Vibration Cause Failure

Metallurgical evaluations of failed components disclosed that the failures were primarily due to fatigue from excessive vibrational and thermal stresses and from local overheating. It was concluded if these causes of failure cannot be changed by design that a material more resistant to high temperatures and the products of combustion is required. An exhaust system made from such a material, Incoloy Alloy 800 (composed of about 20 per cent chromium, 32-34 per cent nickel and iron, and lesser amounts of carbon, manganese, sulfur, silicon, copper, alluminum and titanium) was ground tested for 600 hours without failure. The standard system experienced three typical failures within a 5-10 hour period after about 100 test hours.

FAA tested the exhaust systems of several popular single-engine aircraft, ranging in size from two to six-place. The engines studied in the lengthy analysis are widely-used four and six-cylinder horizontally opposed, ranging from 100 to 260 hp, and having compression ratios from 6.75:1 to 8.6:1. All incorporated exhaust gas-to-air heat exchangers.

The stainless steel alloys now employed in manufacture of exhaust baffles and diffusers become somewhat marginal on engines with compression ratios about 8.5 to 1, when used for periods of extended operation at temperatures of from 1,500 to 1,600° F (which occur at maximum power and lean fuel-to-air mixtures). Steel alloys now in widest use fall victim, under such operating conditions, to the effects of oxidation and carburization, and are attacked by lead compounds, all of which contribute to subsequent failure.

The material costs for a typical single engine light plane exhaust system made of Incoloy 800 should be no more than $10 greater than a system made from stainless steel. The dollar figure is negligible when the lower maintenance and replacement cost, plus added safety and reliability, are considered. A damaged exhaust system robs the engine of power and may set the stage for an in-flight fire or seepage of carbon monoxide gas into the cabin via the aircraft heating system.

The NAFEC tests followed a very methodical procedure. First, a series of flight tests were flown to measure the vibration and temperature levels of the engine and exhaust system during takeoff, from the beginning of the roll and ending at 300 feet altitude. Temperature and vibration were also measured with the engine at cruise speed at altitudes of 4,000 to 7,000 feet.

In the ground tests, six test engines were mounted three abreast on ruggedly built stands, incorporating all of the engines' normal components found forward of the firewall in an actual installation. The normal shock absorbing engine mount assemblies were employed for each engine, just as they would be installed in an aircraft.

The only changes were the addition of supplementary air scoops and oil coolers to permit prolonged engine operation on the ground—a needed precaution, since some of the engines were run as much as 80 hours per week. Engine power was absorbed by the same size and type of propeller which the engine/airplane combination would use in normal flight.

Monitoring Metal Temperatures

In both the flight and the ground phase of the testing, identical instrumentation was used. Exhaust gas temperatures were measured inside the stack or the manifold, and in the tailpipe. Metal temperatures were monitored at different locations on the stack, manifold, tailpipe, and at two places on the muffler outer wall.

Vibration sensing devices were placed on or close to the exhaust flange locations, and measurements were made in each of the three major engine axes. Accelerometers were also placed on the muffler or heat exchangers. Thus equipped, FAA engineers and technicians were able to obtain accurate temperature and vibrations readings throughout the entire range of engine power settings. These provide a valid basis on which to base the design of the exhaust systems and the metals that go into them.

Full reports of FAA's exhaust system studies can be obtained for $3 each from the Clearinghouse for Federal and Scientific Information, Springfield, Va. 22150. The reports describing the tests above are: AD 671-894 "Reciprocating Engine and Exhaust Vibration and Temperature Levels in General Aviation Aircraft," and AD 672-034 "Metallurgical Evaluation of Aircraft Exhaust System Components Failed During Ground Test Program." ■

STATUS OF THE FEDERAL AVIATION REGULATIONS

As of September 23, 1968

Beginning with this issue, FAA AVIATION NEWS will publish a review, or *status sheet,* quarterly of all Federal Aviation Regulations. The status sheet will indicate the number of changes which have been issued to date for each Regulation.

Changes are normally sent automatically without charge to purchasers of Federal Aviation Regulations. Check or money order for FARs should be made out to "Superintendent of Documents" and sent to:

U.S. Government Printing Office
Washington, D.C. 20402.

FAR PART NO.	TITLE	PRICE	CHANGES
1	Definitions and Abbreviations	$0.35	15
11	General Rule-Making Procedures	.20	8
13	Enforcement Procedures	.25	6
15	Nondiscrimination in Federally Assisted Programs of the Federal Aviation Administration	.20	....
21	Certification Procedures for Products and Parts	.60	18
23	Airworthiness Standards: Normal, Utility, and Acrobatic Category Airplanes	1.25	6
25	Airworthiness Standards: Transport Category Airplanes	2.25	16
27	Airworthiness Standards: Normal Category Rotorcraft	.70	2
29	Airworthiness Standards: Transport Category Rotorcraft	.75	3
31	Airworthiness Standards: Manned Free Balloons	.20	2
33	Airworthiness Standards: Aircraft Engines	.40	3
35	Airworthiness Standards: Propellers	.30	2
37	Technical Standard Order Authorizations	1.00	5
39	Airworthiness Directives	.10	1
43	Maintenance, Preventive Maintenance, Rebuilding, and Alteration	.30	7
45	Identification and Registration Marking	.20	5
47	Aircraft Registration	.25	5
49	Recording of Aircraft Titles and Security Documents	.20	4
61	Certification: Pilots and Flight Instructors	.70	29
63	Certification: Flight Crewmembers Other Than Pilots	.35	9
65	Certification: Airmen Other Than Flight Crewmembers	.35	12
67	Medical Standards and Certification	.25	6
*71	Designation of Federal Airways, Controlled Airspace, and Reporting Points	.20	4
*73	Special Use Airspace	.20	1
*75	Establishment of Jet Routes	.20	2
*77	Objects Affecting Navigable Airspace	.35	5
91	General Operating and Flight Rules	.70	34
93	Special Air Traffic Rules and Airport Traffic Patterns	.35	12
**95	IFR Altitudes	.20	....
**97	Standard Instrument Approach Procedures	.20	1
99	Security Control of Air Traffic	.25	6
101	Moored Balloons, Kites, Unmanned Rockets and Unmanned Free Balloons	.20	2

FAR PART NO.	TITLE	PRICE	CHANGES
103	Transportation of Dangerous Articles and Magnetized Materials	.20	4
105	Parachute Jumping	.20	3
121	Certification and Operations: Air Carriers and Commercial Operators of Large Aircraft	1.50	29
127	Certification and Operations of Scheduled Air Carriers with Helicopters	.35	9
129	Operations of Foreign Air Carriers	.20	4
133	Rotorcraft External-Load Operations	.20	3
135	Air Taxi Operators and Commercial Operators of Small Aircraft	.35	5
137	Agricultural Aircraft Operations	.25	3
141	Pilot Schools	.35	6
143	Ground Instructors	.20	3
145	Repair Stations	.40	8
147	Mechanic Schools	.20	1
149	Parachute Lofts	.20	1
151	Federal Aid to Airports	.40	21
153	Acquisition of U. S. Land for Public Airports	.20	2
155	Release of Airport Property from Surplus Property Disposal Restrictions	.20	....
157	Notice of Construction, Alteration, Activation, and Deactivation of Airports	.15	1
159	National Capital Airports	.30	9
161	(Deleted effective 6/1/66)		
163	(Deleted effective 7/1/65)		
165	Wake Island Code	.30	1
167	Annette Island, Alaska, Airport	.15	....
171	Non-Federal Navigation Facilities	.25	3
181	(Rescinded 4/1/67)		
183	Representatives of the Administrator	.20	Re-issued
185	Testimony by Employees and Production of Records in Legal Proceedings	.20	March 1968 "
187	Fees	.20	"
189	Use of Federal Aviation Administration Communications System	.15	"

* Changes to individual airspace designations and airways descriptions, individual restricted areas, and individual jet route descriptions are not included in the basic Parts 71, 73 and 75 respectively because of their length and complexity. Such changes are published in the Federal Register and are included on appropriate aeronautical charts.

** Due to the complexity, length, and frequency of issuance, enroute IFR altitudes and instrument approach procedures are published in the Federal Register, the Airman's Information Manual, and are depicted on the aeronautical charts. Therefore, they are NOT included in the basic Parts 95 and 97.

famous

FLYERS

THE FLYING COWBOY

Cody's biplane, huge by the standards of the time, brought him fame at the British Miltitary Trials in 1912. The single-engine, two-propeller plane had moveable ailerons.

TO AMERICANS the name Cody has long been linked with the Wild West, with its untamed horses and thundering buffalo herds. But to Britons the name brings to mind the man who made the first powered flight in England—Samuel F. Cody. Paradoxically, Britain's aviation pioneer was a product of the American west, a Montana cowpoke who fascinated the British by dressing like a Hollywod sheriff.

Born on his father's ranch in Birdville, Texas on March 6, 1861, Sam Cody survived frontier wars and Indian raids. The ranch's Chinese cook provided a diversion from daily hardships by instructing young Cody in Oriental kite lore dating back to the 3rd century B.C.

At the age of 19 Cody signed on as a trail boss to deliver a herd of cattle to Montana. He went on to the Klondike to try his luck briefly as a gold miner, then returned to Montana to ride the range. The wind-swept buttes of that mountainous state rekindled Cody's youthful interest in kites and inspired him to build a man-carrying kite which he flew on a meadow near his mining claim.

But Wild West circuses were more lucrative than kite building, so Cody left Montana and joined Forpaugh's Circus as a marksman and exhibition rider. During a trip he made to Europe with a shipment of horses, he married the daughter of one of his English associates, John Davis—she was also an excellent rider and sharpshooter. Cody and his bride soon teamed up to start their own show. After touring Europe for several years, the Cody family, now including 3 sons, returned to England.

Developed Wing Warping

Cody perfected a man-carrying kite with improved control derived by warping the trailing edge of the kite wings, and exhibition kite flying became part of the Cody Show. He patented his wing-warping kite design in 1901; this feature was also incorporated in the Wright brothers' patents which were applied for in 1903 when they built their first successful powered airplane.

By 1903 Sam Cody's kite experiments had attracted the attention of the Royal British Navy. He was commissioned to demonstrate the reconnaissance potential of the man-carrying kite in July. The trials went well until the cruiser that was towing Cody began to take a downwind course and, since kites can only be flown against the wind, Cody's kite spiraled to the water. With recognizable horsemanship, Cody dived out of the kite about thirty feet above the sea and swam around while the kite crashed.

Cody was then hired by the British War Department to continue his kite experiments. During these years, he also became an expert balloon-pilot and flew the first British dirigible, powered with a 15 hp engine of French design.

Using the dirigible's engine (which had to be returned to the dirigible occasionally) Cody next developed an airplane which made the first successful recorded flight in Great Britain on May 16, 1908. Subsequently on Septmber 29th he made a second flight of longer duration (78 yards) and on October 16th, he made a flight of 496 yards. The flight ended with Sam Cody and the airplane in a stand of trees after a height of 50 to 60 feet had been achieved. Miraculously Cody was not seriously injured, and enough of the plane was left to re-equip it with a 50 hp engine and improve on the ignition and carburetor.

One of the British criteria for aircraft competing for a record was that the plane must take off under its own power. To lighten his plane Cody used an agricultural plow seat instead of the usual bucket seat. The press found this innovation hilarious but they stopped laughing when Cody broke the world's record by being the first pilot to carry three passengers in a heavier-than-air machine.

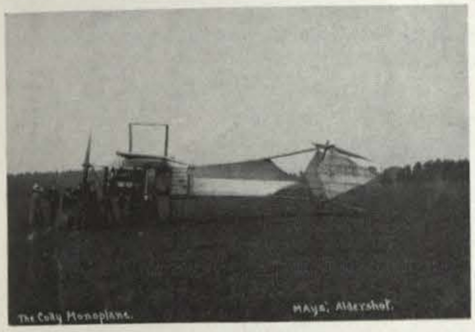
With rakish mustache and goatee, Cody cut a dashing figure at British air shows.

Promotes Himself

In August, 1909, Cody was awarded the Silver Medal of The Royal Aeronautical Society for his services to aeronautics. By that time Cody felt he deserved to be considered above the ranks of the average man so he picked up the title of colonel. The title became "official" after the King of England addressed him as "Colonel Cody," following Cody's record breaking cross-country flight of one hour and six minutes in the air, on September 8, 1909.

From 1909 until 1912 Cody entered and won competitions all over England. He developed better planes and incorporated the English Green 60 hp four cylinder engine into them. At one point he even tried using two engines to drive one propeller but this experiment failed. He also improved the performance of his plane "The Centenary" by adding an eight-gallon auxiliary oil tank, which fed oil to the crankcase at the same rate that oil was consumed by the engine—an important innovation, in those days, when engines swallowed oil almost as rap-

Above—Crowd presses close to view Cody biplane during 1913 exhibition. Bottom—In an age when biplanes were supreme, Cody designed this highly efficient monoplane.



idly as gasoline.

The highlight in Cody's aviation career came at the Military Trials held in August of 1912. In a test flight he had a motor failure and hit an unfortunate cow on landing, demolishing the cow and the airplane. With just one month remaining until the trials, Cody put the 120 hp engine from the wrecked airplane into a 1911 plane and went on to win.

Winning the Military Trials was the most prestigious victory for pilots in England. Just meeting the stringent requirements was quite a feat. One rule required the plane to carry 4½ hours fuel, reach a height of 4,500 feet, and stay up for 3 hours, one hour of which must be above 1,500 feet.

Cody continued to win aviation events until aviation enthusiast Lord Northcliffe offered a prize of £5,000 for a waterplane flight around Great Britain. This was Cody's last effort—he was killed with a passenger, W. H. B. Evans, in a pusher type pontoon-equipped airplane. The aircraft was seen to break apart while making an approach to a landing. Later it was discovered that the four-bladed propeller had disintegrated, cutting off the tail of the airplane.

Ironically, if the cowboy-aviation pioneer had survived this race he might have become one of the internationally recognized giants of aviation. He had already begun planning a 400 hp engine for a transatlantic flight, for which Lord Northcliff was offering a prize of £10,000. Three thousands miles of chilly Atlantic would hardly have daunted this hardy son of the Old West, who vaulted from a horse's back into the center ring of aviation history. *Harriet Weber*

Pilot BRIEFS

• STOL RUNWAYS have been marked and lighted in accordance with approved criteria at Dulles and Washington National Airports, utilizing portions of existing taxiways. Washington Airlines, Inc., inaugurated scheduled STOL service between Dulles, Friendship and WNA in late September. Three Dornier Skyservant aircraft provide the service.

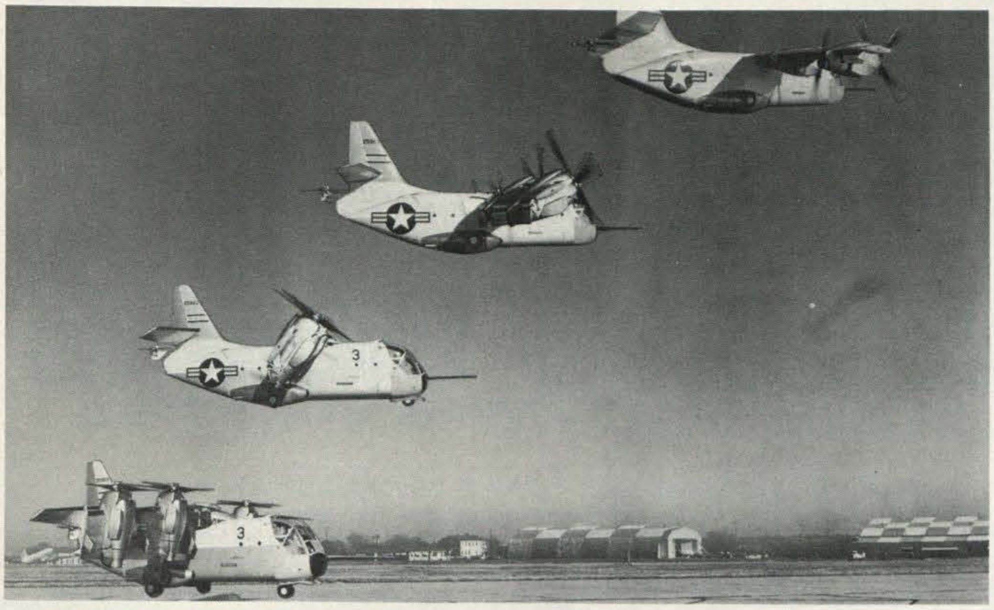
• CHANGES IN CURRENT AIR TRAFFIC PROCEDURES are being planned by FAA as a stopgap measure for easing the pressure and reducing delays at high density terminals. Curtailed service may include reducing hours of tower operation and eliminating PAR (Precision Approach Radar) service at some locations; cutting down on VFR flight plan service; and relocation of some controller positions. Emergency action is necessary because of the time lag of about two years before the effects of accelerated controller and training will be felt.

• FAA's FOURTH ANNUAL MAINTENANCE SYMPOSIUM will emphasize the importance of the human factor in the aircraft maintenance system. With "The Man in the Maintenance Reliability System," as its theme, this year's get-together of civilian and military leaders of the aviation community will take place December 3-5 at the Skirvin Hotel, Oklahoma City, Okla. For details write to: FAA Maintenance Division, FS-300, Department of Transportation, 800 Independence Avenue, S.W., Washington, D. C. 20590.

• SECRET SERVICE AGENTS now have access to, and may occupy a seat on the flight deck of an aircraft carrying any person whose protection is a responsibility of the United States Secret Service. Authorization is granted under Special Federal Regulation Nr. 19 (Docket 9031), effective July 26, 1968.

• IT'S BACK TO THE CLASSROOM and the laboratory for FAA's new crop of air traffic controllers and flight service specialists when the agency resumes air traffic initial training at the FAA Academy, Oklahoma City, this November. The first classes will have about 20 trainees in each of the three options—terminal, enroute center, and flight service station. An estimated 3,000 trainees will pass through the schools by the end of June, 1969.

• PERMISSION TO LAND AT SAN ANTONIO Airport is required for all aircraft arriving from Mexico. U.S. Treasury Department has advised that San Antonio is not an international "airport of entry," but a "landing rights" airport. This correction should be noted by all users of the leaflet on "Flying Safely to Mexico" published in the May issue of FAA Aviation News.



FAA's air traffic simulator was used to learn best way to handle V/STOL craft like this XC-142A at high density airports. Full details are in "VTOL and STOL Simulation Study".

NEW REPORTS ON COMMUNICATIONS, RADAR, V/STOL

Three recent FAA publications examine in depth subjects ranging from V/STOL operations in busy terminals to a method for assuring peak radar performance.

All the reports are available for $3 each from the Clearinghouse for Federal Scientific and Technical Information (CFSTI), Springfield, Va. 22151. Orders should include the specific title and "AD" number, and include a check or money order payable to CFSTI.

"VTOL and STOL Simulation Study" (AD 760-006), describes tests made at FAA's National Aviation Facilities Experimental Center (NAFEC) near Atlantic City, where it was shown through use of simulated air traffic that V/STOL capability for high rates of climb can be exploited to increase efficiency of terminal operations.

"Nimbus II VHF Multipath Investigations" (AD 669 796) examines the severity of multipath propagation fade effects in satellite-to-aircraft VHF communications. Measurements were made on over-ocean and limited over-land test flights.

"Technical Evaluation of Eidophor" (AD 646 913) follows an earlier study in 1966 which established the value of large screen radar information displays of airport surveillance radar for air traffic control. Radar and beacon information is combined with video map and alphanumeric data projected as a dynamic composite picture on 9-foot by 12-foot displays in the terminal radar control room, supplementing the controller's standard console displays.

Jet Engine Tests at NAFEC Show Effect of Bird Strikes

How bird strikes affect engine performance is the subject of a new FAA publication, "Investigation of Turboprop Engine Characteristics During Bird Ingestion," (AD 668-834), now available at $3 a copy from the Clearinghouse for Federal and Scientific Information, Springfield, Va. 22151.

The tests conducted at FAA's National Aviation Facilities Experimental Center (NAFEC), near Atlantic City, on a 960 h.p. Lycoming T-53-L-3 engine showed that the remains of as few as three or four birds on the inlet guide vanes can reduce engine power 40 to 50 per cent. The restricted air flow can also result in dangerously high engine temperatures.

When birds entered the test engine, power fluctuated from two to four seconds, and the degree of fluctuation was generally a function of the quantity of birds ingested.

No manual manipulation of engine controls was necessary to stabilize the engine. When the power stabilized, however, it was as much as 40 to 50 per cent below the pre-ingestion levels.

The tests showed that the small turboprop engine is not susceptible to flameout during small bird ingestions. No flameouts occurred during the 16 test runs, and there was no visible damage to the engine from bird impact.

When a turbine engine is suspected or known to have "swallowed" birds, it should be carefully inspected before the next flight.

The test was the last in a series of four conducted by FAA in the past five years to determine engine reaction to bird ingestion. Previous tests were on the Allison 501-D13 turbo-prop, the Pratt & Whitney YTF 33-P-1 turbo fan, and the P&W J-57 turbo jet.

Three-year General Aviation Tally Started on Arrivals from Abroad

Foreign general aviation pilots flying into the U.S. in October will be greeted with a courteous salute, a welcome, and a streamlined, one-page "census" report to fill out.

For the first time, American officials will carry out a sustained, long-range tally of all general aviation aircraft entering the U.S. from abroad.

The only similar survey was done in the fall of 1964, when foreign aircraft arriving in the U.S. were logged for a 90-day period. During that time, some 20,000 cards were sent into FAA headquarters, representing an estimated 98 per cent of all pilots contacted.

The up-coming survey is designed to be carried out over a three-year period, four times a year, for a full month each time. The data collected each year will then be multiplied by three to approximate a complete year.

In order to get a realistic picture of international general aviation air traffic coming into the U.S. for a full year, the survey months will be staggered during the three-year period. This will enable the statisticians to get an accurate view of the traffic in spite of seasonal fluctuations.

Following the initial survey in October, the "census" will again be taken in January, April, July, and November in 1969. In 1970, the planned survey months are February, May, August, September, and December. In 1971, the months will be March and June. This will provide data on three full fiscal years.

The purpose of the survey is to provide data on the volume, seasonality, routing and other characteristics of international general aviation operations. This will provide American officials detailed information to work with in requesting equity for charges applied to American general aviation pilots flying abroad.

At the present time, the United States does not levy user charges on foreign aircraft using the national airspace system, and none are contemplated. However, some countries do assess such charges against American general aviation aircraft.

An estimated 120,000 general aviation flights enter the U.S. each year, most of which arrive at a handful of airports. However, Customs inspectors at all airports of entry—the 65 international ports of entry, and the 166 airports having "landing rights" —will be supplied with the "census" forms.

The forms will inquire into the types of aircraft—fixed wing, rotorcraft, single engine, multi-engine, jet or piston—number of persons, weight of cargo and money spent at each point on the itinerary of the aircraft (including place of origin, foreign intermediate airports, last foreign departure airport, U.S. airport of arrival, U.S. intermediate airports, and U.S. destination airport).

FAA Aviation News welcomes comments from the aviation community. We will reserve this page for an exchange of views. No anonymous letters will be used, but names will be withheld on request.

• Bright Idea Man

After reading "Crash Locator Beacons—Should FAA Require Them?" in the May *FAA Aviation News,* the thought occured to me that the Forestry Service lookout towers would make ideal vantage points to aid searchers for downed planes. They are on the highest points in remote areas and they have telephone communication.

In the same issue of *Aviation News,* I found "Propeller Accidents—Who Needs Them?" profitable reading. Especially so after I shouted "Clear" and fired up my engine—and my instructor instantly shut it down and asked, pointedly, why I had started the engine without verifying that no one was in the vicinity of the prop.

Maybe the prop tips could be painted or coated to increase their visibility.

Freemont, Calif.

Your two suggestions are very timely. Preliminary research indicates that many lookout towers manned by Interior and Agriculture Department personnel may be suited for such use. The subject will be thoroughly explored with the government departments involved. It is a first-rate observation on your part.

In regard to your suggestion about painting propeller tips, this agency has a six-inch band painted on the tips of the propellers in its piston engine fleet. The paint recommended is Mil. Spec. Mil-L-19537; color yellow; Federal Standard No. 13538.

• Thank You, Ma'am

This is a king size "Thank you" to all flight service stations and weather bureaus.

I recently completed my first long cross-country flight from Kingston, N. Y. to New Orleans, with stopovers all over the place. Some planned, and some merely diving for refuge from the elements.

Without the helpful cooperation of these fine people, I would probably still be sitting in the boondocks in the state of Heaven-Knows-Where waiting for the miserable weather I encountered to turn into something akin to VFR conditions.

Wherever (and whenever) I landed I always contacted one of these agencies to learn whether my proposed route for flight was practical, or even possible. All I had to say was "I am a GREEN pilot and quite aware of my limitations" and they would go out of their way to explain weather situations and make sure I understood them.

"Thank You" seems a mighty small way of expressing my gratitude. I just don't know any other way.

Madelyn M. Eyles
Kingston, N. Y.

• Low Time Pilots

What expression could an inexperienced pilot use when talking to a ground controller to alert the controller that he is a low-time pilot?

For instance, when we were student pilots we used the expression "student pilot" after each transmission. Now that I have a private license occasions arise when I want to inform controllers that they are dealing with an inexperienced pilot. When flying alone I often still use the phrase "private pilot", but this would not be applicable when carrying passengers.

Charles E. Aimar, M.D.
Darlington, S. C.

FAA Air Traffic Service has no set phrase to identify inexperienced pilots, but controllers polled are agreed that a pilot's tone of voice and use of aeronautical phraseology provides a good clue to his proficiency. The tower can be depended upon to provide understanding handling of all of its contacts.

• Aircraft Identification

In the many varied conditions encountered in flight, location of other aircraft above or below becomes very difficult at times due to the solid color paint schemes and the bright aluminum structures of airline and military aircraft.

I suggest that all aircraft be required to display license numbers on the lower left wing and the upper right wing as was required years ago, and also that the license numbers be displayed on the fuselage as at present.

I further suggest that the numbers be ⅓ of the observed surface in height, and be 2 inches thick for light single-engine craft; 4 inches thick for light twins; and 6 inches thick for large multi-engine planes and jet aircraft. The colors should be contrasting, such as black on white wing, or white or dark wings such as solid red, green, blue, etc. Numbers on aluminum-skinned aircraft should be painted in red luminescent paint.

Arthur Rule
San Jose, Calif.

A study of all factors that could conceivably reduce the mid-air collision hazard is currently underway and is expected to be released early in 1969.

Your thoughtful suggestion will be given full consideration in the course of the study. As a point of information, the Federal Aviation Regulations do not prohibit display of wing markings, in addition to the required side markings, if the owner wishes to display such marks.

• Navaid Lighthouse?

I just read "How True is Your Omni?" *(FAA Aviation News,* June 1968). I can feel for the pilot who was lost because his omni was malfunctioning.

Something has been bugging me for quite some time and now I believe is the time to write to you. All omni stations have a tower or cone. Some are placed on a building painted red and white, while others are just the cone painted white. What would be wrong if a blue or some other color strobe light were to be placed on top of the omni tower?

This would prevent a pilot from weaving all over the sky in bad weather, or when the omni is malfunctioning.

John S. Wolf
Millville, N. J.

Addition of a strobe light has some merit, but it also has the drawback of creating possible confusion when viewed from above, especially at night or in foul weather. The winking light could be mistaken for an aircraft passing below.

• Seeks to Expand Data

On most charts there would appear to be adequate space to list air-ground communications for all the airdromes which are covered by these charts. I am certain adding these data would avoid a great deal of cockpit confusion.

I would therefore like to suggest that the above modification be given serious consideration by the FAA.

John G. Lawton
Avionics Department
Cornell University

• Here's What it Takes

How many hours dual, and how many hours solo are required by regulations to qualify for a private pilot license? I've had people claim that all the regulations require is three hours dual, and this is only after solo cross-country.

A. S. Hurst
Chattanooga, Tenn.

Federal Aviation Regulations require at least 40 hours of flight time to meet the requirements for a private pilot certificate. This includes 20 hours of solo flight, of which 10 hours must be cross-country.

Complete details on private pilot certificate requirements can be found in "Private Pilot Airplane, Single-Engine, AC 61-3B (20 cents)", and "Student Pilot Guide, AC 61-12B (15 cents)", available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

U.S. GOVERNMENT PRINTIN
DIVISION OF PUBLIC DOCU
WASHINGTON, D.C. 2(
OFFICIAL BUSINE
RETURN AFTER 5 DAYS

AVN NOV
ARTHUR A CARTER JR
2145 N PIERCE ST, APT 7
ARLINGTON VA 22209

POSTAGE AND FEES PAID
U.S. GOVERNMENT PRINTING OFFICE

Locator signs are a blessing

They keep pilots from second guessing